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February 25, 1983
C-586-2-3-40

Mr. R. D. Stonebraker, Deputy Chief
Emergency & Remedial Response Branch
Air & Waste Management Division
Environmental Protection Agency
345 Courtland Street, N.E.
Atlanta, Georgia 30365

Dear Mr. Stonebraker:

This letter provides our conclusions and recommendations on the Saad sampling study in Nashville, Tennessee. To support our ideas a brief geological summary is first provided.

The Saad Site and Croft farm are both underlain by rocks of the Ordovician Age. The two formations underlying the site are the Bigby Cannon Limestone and the Hermitage Formation, respectively. Both formations range in thickness from 60 to 100 feet. The Bigby Cannon limestone is dark gray to brownish-gray in color, thin to medium bedded with pronounced conchoidal fracturing present. Fracture zones in the formation tend to form solution cavities due to groundwater movement. Because of the extensive fracturing, a network of groundwater pathways may develop in the formation making ground-water flow possible in numerous directions. Sinkholes have developed in the vicinity of the site creating recharge zones for groundwater. The Croft spring is a discharge point for groundwater under the site and is believed to be at the contact of the Bigby Cannon Limestone and Hermitage Formation. The stream formed by the Croft spring flows into Seven Mile Creek which joins Mill Creek in route to the Cumberland River. Approximately 1/2 mile downstream of the Cumberland River and Mill Creek confluence is the river intake for the city of Nashville's drinking water purification system. The total distance from the Croft spring to the river intake is approximately 9 1/2 nautical miles.

The effects of poor waste management in such geological localities is demonstrated by the impact of Saad's operation is Smyrna, Tennessee. In less than one year following the surface dumping of liquid organics, wells close to the disposal in several directions were contaminated. Wells along the apparent major groundwater flow path at distances over 1 mile away also were polluted. Thus the potential for rapid contaminant movement in groundwater is high.

The Saad sink hole, as indicated by the boring logs of the monitoring well, extends downward to the top of the Bigby-Cannon some 16 feet below the land surface. The monitoring well was installed through the waste zone and into a water bearing

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fracture near the contact of the two limestone formations. A geological cross-section of the subsurface below the Saad Site is detailed in the attached sketch. It is noteworthy that 6 of the 7 most concentrated purgeable organics found in the monitoring well water were also found in the shallow soil sample collected in the pit. These six common contaminants were found in the parts per million range in both the soil and water. This level of groundwater contamination is distrubingly high, particularly in a limestone karst situation where rapid contaminant migration is possible without soil attenuation. Since these levels of groundwater contaminants were only found below the pit it is suggestive that the Saad Site is a major pollution source.

Ten organic compounds found in the groundwater below the Saad pit were also groundwater contaminants below L & N, but at much lower concentrations (an average of 120 fold less). This finding suggests that the Saad waste is contributing to groundwater pollution below the Radnor Yards.

Only one well was installed in the L & N property which covers 137 acres. Therefore this study is not a thorough characterization of the groundwater below the railroad yard. This deficiency may account for the absence of diesel fuel in L & N groundwater which is surprising given the railroads past operational history.

Five organic compounds found in L & N and Saad groundwater were also groundwater contaminants on the Croft farm. Three organic compounds were found in the first Croft spring water samples that were found in the Saad groundwater, one of these was also found in L & N groundwater. No organics were found in the spring water from the second sampling. This variation in contaminants makes it impossible to accurately assess the spring pollution or to compare spring water analysis data with contamination at L & N and Saad.

The vast preponderance of the organic compounds detected in the groundwater samples are chlorinated hydrocarbons which are of significant public health concern. The ingestion of many of the chlorinated hydrocarbons found at the site can result in the depression of the central nervous system, gastrointestinal upset, and liver and kidney degeneration. A more insidious hazard is presented by the carcinogenic potential of a few of these compounds. In 1978 twenty-one chemicals found in this country's drinking water supplies were characterized as having carcinogenic activity; four of these compounds are found in the water at the Saad Site (vinyl chloride, chloroform, 1-2 dichloroethane and benzene are suspected of causing adenocavcinoma and leukemia respectively). The concentrations of these four compounds, particularly in the ground water below the Saad pit, are high for

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water samples and unacceptable particularly in view of the belief that carcinogens can act in a nonthreshold fashion.

Particularly noteworthy is the absence of diesel fuel in the spring which was thought to be a major contaminant because of reported diesel fuel odors and the operational practices at L & N. A more thorough sampling would perhaps allow for evaluation of contaminant variation and provide insight regarding pollution sources.

Based upon our experiences to date FIT makes the following recommendations:

- o FIT recommends the removal of contamination from the Saad sink area. Sampling strongly indicates this area is a groundwater pollution source providing high concentrations of toxic organics. The complete removal of this contamination may be difficult because a building has been erected over the filled sink area. A thorough engineering feasibility analysis is required.

- o Due to the apparent seasonal fluctuations in the depths of the groundwater table, a long term sampling schedule that includes the monitoring wells and Croft farm springs is recommended. Past sampling has shown that samples collected at different times contain different contaminants. A long-term program should better identify the types and concentrations of contaminants and support a more accurate hazard assessment.

- o The feasibility of the installation of additional monitoring wells should be considered. Additional wells may more accurately locate the flow paths of contamination, characterize contaminants and provide needed background data. Also, the direction of groundwater flow patterns in the karst area could be more accurately determined. However in the karst geology, tracking of the plumes may be impractical and the feasibility study should recognize this risk.

- o The FIT sampling study only included one well on the L & N property, consequently this suspected pollution source is poorly characterized. FIT recommends that EPA consider the value of a more complete monitoring well program for the Radnor Yards. FIT could assist in this evaluation by providing a design and cost estimates.

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- The two residential wells were contaminated with two organic compounds also found in the groundwater below the Saad pit. One of these compounds was found in one of the Croft farm wells. FIT recommends a thorough sampling of all local private wells to further evaluate water quality.

I hope you find the above comments useful in further management of the site's pollution problems. If you need further assistance from FIT please let me know.

Sincerely,

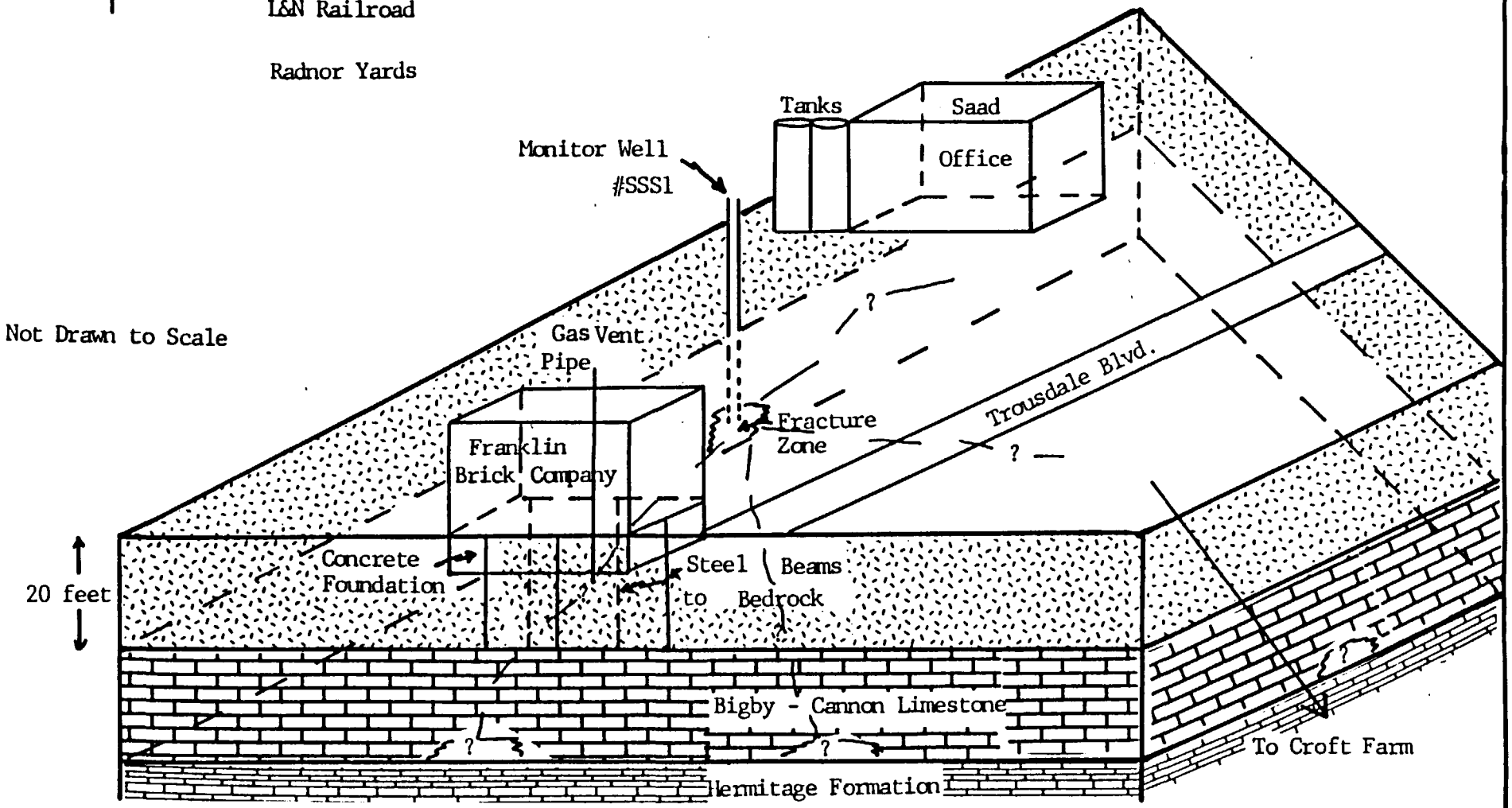
Roger Franklin

R. Roger Franklin
Environmental Scientist

RF/ms

Based on existing data concentrated waste exists in an area of 0.6 acres and is approximately 20 feet deep. Waste Volume is estimated to be 18,650 cubic yards.

Reference: Figure 3.1 & 3.2 Installation of Monitor Wells, Saad Site, Nashville, TN. FIT Report #F4-8204-06



Legend

Waste Material

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Region IV Atlanta

Generalized Sketch of Subsurface Beneath Saad Site Nashville, Tennessee

1. Water Supply - location
2. Cross-section - drawing

1. Sample wells - TDD
2. Organisms at spring? API or Athens
3. Vent pipe at Brick Yard - AIR MONITOR
4. TOX - write up